Digital Imaging and Communications in Medicine (DICOM)

Supplement 20

X-Ray 1024 Media Application Profile

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Annex X (Normative) - 1024 X-ray Angiographic Application Profile

X.1 CLASS AND PROFILE IDENTIFICATION

This Annex defines a class of Application Profiles for 1024 X-ray Angiographic clinical applications. The identifier for this class shall be STD-XA1K. It is the intent of this profile to be backward compatible with the Basic Cardiac X-ray Angiographic Application Profile (STD-XABC-CD) in PS 3.11 Annex A.

The specific Application Profiles in this class are shown in the Table 1.

Table 1 - 1024 X-ray Angiographic Profiles

Application Profile	Identifier	Description
1024 X-Ray Angiographic Studies on CD-R Media	STD-XA1K-CD	It handles single frame or multi-frame X-ray digital images up to 1024x1024x12 bits; biplane acquisitions are encoded as two single plane information objects. Secondary Capture images are supported.

X.2 CLINICAL CONTEXT

This class of Application Profiles facilitates the interchange of primary digital X-ray cine runs, typically acquired as part of angiographic procedures. Typical media interchanges would be from in-lab acquisition equipment to either a display workstation or to a data archive system, or between a display workstation and a data archive system (in both directions).

Additionally, images derived from or related to primary digital X-ray cine runs, such as quantitative analysis images, reference images, multi-modality images and screen capture images, may be interchanged via this Profile.

The operational use of the media interchange is potentially both intra-institutional and inter-institutional.

Note: An FSC conforming to the Basic 512 Cardiac Angiographic Profile and General Purpose CD-R Profile supporting the SC Image Media Storage SOP Class could, if the restrictions in this profile were observed, create images that were readable by an FSR supporting the profile. Conversely, SC Images written by an FSC conforming to this profile, would be readable by an FSR conforming to the Basic 512 Cardiac Angiographic Profile and the General Purpose CD-R Profile supporting the SC Image Media Storage SOP Class.

X.2.1 Roles and Service Class Options

This Application Profile Class uses the Media Storage Service Class defined in PS 3.4 with the Interchange Option.

The Application Entity shall support one or more of the roles of File-set Creator, File-set Reader, and File-set Updater, defined in PS 3.10.

X.2.1.1 File Set Creator

The Application entity acting as a File-Set Creator generates a File Set under the STD-XA1K Application Profile Class. Typical entities using this role would include X-ray angiographic lab equipment, and archive systems which generate a patient record for transfer to another institution. File Set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR File with all types of Directory Records related to the SOP Classes stored in the File-set.

An FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc).

> Note: A multiple volume (a logical volume that can cross multiple physical media) is not supported by this Application Profile Class. If a set of Files, e.g., a Study, cannot be written entirely on one CD-R, the FSC will create multiple independent DICOM File-set such that each File-set can reside on a single CD-R medium controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the discs to reflect that there is more than one disc for this set of files (e.g., a Study).

X.2.1.2 File Set Reader

The role of File Set Reader shall be used by Application Entities which receive a transferred File Set. Typical entities using this role would include display workstations, and archive systems which receive a patient record transferred from another institution. File Set Readers shall be able to read all the defined SOP Instances files defined for the specific Application Profiles to which a conformance claim is made, using all the defined Transfer Syntaxes.

X.2.1.3 File Set Updater

The role of File Set Updater shall be used by Application Entities which receive a transferred File Set and update it by the addition of processed information. Typical entities using this role would include analytic workstations, which for instance may add to the File Set an information object containing a processed (e.g., edge-enhanced) image frame. Stations which update patient information objects would also use this role. File-set Updaters shall be able to read and update the DICOMDIR file. File-set Updaters do not have to read the image information object. File-set Updaters shall be able to generate any of the SOP Instances files defined for the specific Application Profiles to which a conformance claim is made, and to read and update the DICOMDIR file.

An FSU shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc).

> Note: If the disc has not been finalized, the File-set Updater will be able to update information assuming there is enough space on the disc to write a new DICOMDIR file, the information, and the fundamental CD-R control structures. CD-R control structures are the structures that are inherent to the CD-R standards; see PS 3.12

X.3 STD-XA1K-CD APPLICATION PROFILE CLASS REQUIREMENTS

X.3.1   SOP Classes and Transfer Syntaxes

This Application Profile is based on the Media Storage Service Class with the Interchange Option (see PS 3.4).

SOP Classes and corresponding Transfer Syntaxes supported by this Application Profile are specified in Table 2.

Table 2 - STD-XA1K-CD SOP Classes and Transfer Syntaxes

Information Object Definition	Service Object Pair Class UID	Transfer Syntax and UID	FSC Require ment	FSR Require ment	FSU Require ment
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	Mandatory	Mandatory	Optional
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Mandatory	Optional
Standalone Overlay	1.2.840.10008.5.1.4.1.1.8	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Optional	Optional
Standalone Curve	1.2.840.10008.5.1.4.1.1.9	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Optional	Optional
Detached Patient Management	1.2.840.10008.3.1.2.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	Optional	Mandatory	Optional

X.3.2   Physical Media And Media Formats

1024 X-Ray Angiographic Application Profiles in the STD-XA1K class require the 120mm CD-R physical media with the ISO/IEC 9660 Media Format, as defined in PS3.12.

X.3.3   Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set.

Note: DICOMDIRs with no directory information are not allowed by this Application Profile.

X.3.3.1 Additional Keys

Table 3 specifies the type of Directory Records that shall be supported and the additional associated keys. Refer to the Basic Directory IOD in PS3.3.

Table 3 - STD-XA1K Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Level	Type	Notes
Date of Birth	(0010,0030)	PATIENT	2	
Sex	(0010,0040)	PATIENT	2	
Institution Name	(0008,0080)	SERIES	2	
Institution Address	(0008,0081)	SERIES	2	
Performing Physician	(0008,1050)	SERIES	2	
Icon Image Sequence	(0088,0200)	IMAGE	1	
Image Type	(0008,0008)	IMAGE	1C	Required if the SOP Instance referenced by the Directory Record is an XA Image.
Calibration Image	(0050,0004)	IMAGE	2	
Referenced Image Sequence	(0008,1140)	IMAGE	1C	Required if the SOP Instance referenced by the Directory Record is an XA Image and has an Image Type (0008,0008) value 3 of BIPLANE A or BIPLANE B.
>Referenced SOP Class UID	(0008,1150)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present
>Referenced SOP Instance UID	(0008,1155)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present

X.3.3.2 Icon Images

Directory Records of type IMAGE shall include Icon Images. The icon pixel data shall be Bits Allocated and Bits Stored (0028,0101)attribute values of 8 with Row (0028,0010) and Column (0028,0011) attribute values of 128 and Photometric Interpretation (0028,0004) attribute value of MONOCHROME2.

Notes: 1. It is recommended that the Icon Images be encoding using VR OB encoding. The use of OW, allowed by the STD-XABC-CD Basic Cardiac profile defined in PS 3.11 Annex A, is deprecated, and may be retired in future versions of the standard.

2. This icon size is larger than that recommended in PS 3.10 because the 64x64 icon would not be clinically useful for identifying and selecting x-ray angiographic images.

3. For multi-frame images, it is recommended that the icon image be derived from the frame identified in the Directory Frame Number attribute (0028,6010), if defined for the image SOP Instance. If the Directory Frame Number is not present, a frame approximately one-third of the way through the multi-frame image should be selected. The process to reduce any image to a 128x128 image is beyond the scope of this standard.

X.3.4 Other Parameters

This section defines other parameters common to all specific Application Profiles in the STD-XA1K class which need to be specified in order to ensure interoperable media interchange.

X.3.4.1 Image Attribute Values

The attributes listed in Table 4 used within the X-Ray Angiographic Image files have the specified values.

Table 4 - STD-XA1K-CD Required XA Image Attribute Values

Attribute	Tag	Value
Modality	(0008,0060)	XA
Rows	(0028,0010)	up to 1024 (see below)
Columns	(0028,0011)	up to 1024 (see below)
Bits Stored	(0028,0101)	8, 10, and 12 bits only

Notes: 1. An FSC or FSU, when creating or updating a File-set, Rows or Columns will not exceed a value of 1024. When reading a File-set, an FSR or FSU will accept all values of up to 1024 for Rows or Columns.

2. Photometric Interpretation, Pixel Representation, High Bit, Bits Allocated and Samples per Pixel are defined in the XA IOD.

The attributes listed in Table 5 used within the Secondary Capture Image files have the specified values.

Table 5 - STD-XA1K-CD Required SC Image Attribute Values

Attribute	Tag	Value
Rows	(0028,0010)	up to 1024 (see below)
Columns	(0028,0011)	up to 1024 (see below)
Samples per Pixel	(0028,0002)	1
Photometric Interpretatation	(0028,0004)	MONOCHROME2
Bits Allocated	(0028,0100)	8 bits only
Bits Stored	(0028,0101)	8 bits only
High Bit	(0028,0102)	7
Pixel Representation	(0028,0103)	0000H (unsigned)

Note: An FSC or FSU, when creating or updating a File-set, Rows or Columns will not exceed a value of 1024. When reading a File-set, an FSR or FSU will accept all values of up to 1024 for Rows or Columns.

Overlay Group 60XX shall not be present in Secondary Capture Images, and Standalone Overlays shall not be referenced by or to Secondary Capture Images used in this profile.

X.3.4.2 Multiframe JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames.

X.3.4.3 Attribute Value Precedence

The values of attributes contained in a Detached Patient Management SOP Instance referenced by a DICOMDIR PATIENT Directory Record shall take precedence over the values of those attributes contained in a SOP Instance referenced by a subsidiary Directory Record. The DICOMDIR Directory Records shall have key attribute values in accordance with this precedence.

> NOTE: This allows patient identification and demographic information to be updated without changing the composite Image IOD files. The DICOMDIR file thus is critical in establishing the link between the updated information and the image. As an example, at the time an Image file was written, the patient's name therein was incorrect, or inconsistent with the Hospital Information System records. Subsequently, a Detached Patient Management file with the corrected name is added to the file-set. The FSR should use the name from the Patient file rather than the name in the Image file.